



SPICE Models for Alpha Microprocessors : An Application Note

This application note provides pin-to-model reference tables for design engineers who conduct SPICE simulations of Alpha microprocessors.

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1 Document Organization

This document contains pin-to-model reference tables to assist you in cross-referencing Level 28 SPICE models with an 21164 Alpha microprocessor.

2 Intended Audience and Prerequisites

This application note is for users who are familiar with SPICE. This document provides information for design engineers who will conduct simulations of SPICE models for the 21164 Alpha microprocessor.

3 SPICE Model Description

You can use the SPICE models to simulate either *Worst Case* (WC) or *Best Case* (BC) operating conditions. The SPICE model files contain subcircuits, which provide a description of the connectivity and the parameters to be used with the model.

Most of the input pins have only one subcircuit that functions for either operating condition. However, all of the driver pins and some of the input pins have two separate driver subcircuits that correspond to the two operating conditions. Either subcircuit may be instantiated for SPICE simulation, depending on the operating condition desired.

4 Reference Table Conventions

The following conventions are used in all of the pin-to-model reference tables.

Convention	Description
Pin Name	This indicates the name of the signal pin on the chip.
Pin Type	This indicates whether the pin is an input (I), output (O), open drain output (OD), or bidirectional (I/O) pin.
File Name of Model	This indicates the name of the SPICE model file for the pin.
Subcircuit names ending with WC	This indicates the <i>Worst Case</i> operating condition.
Subcircuit names ending with BC	This indicates the <i>Best Case</i> operating condition.
Extents	Extents are specified by a pair of numbers in angle brackets (<>) that are separated by a colon (:) and are inclusive. For example, bits <0:3> indicates an extent including bits 0, 1, 2, and 3.

5 21164 Alpha Microprocessor Pin-to-Model Reference Table

Table 1 lists all the signal pins and the corresponding Level 28 SPICE models to use for the 21164 Alpha microprocessor. The subcircuits are simulated with the following *Worst Case* (WC) and *Best Case* (BC) operating conditions:

- Subcircuit names ending with WC have an operating condition of **Vdd** at 3.00 V with a temperature of 85°C (185°F).
- Subcircuit names ending with BC have an operating condition of **Vdd** at 3.60 V with a temperature of 25°C (77°F).

Table 1 21164 Alpha Pins with Corresponding Level 28 Models

Pin Name	Pin Type	File Name of Model	Model Subcircuits
addr_bus_req_h	I	I_21164.SPI	VIN_WC, VIN_BC
addr_cmd_par_h	I/O	B_21164.SPI	VIOD_WC, VIOD_BC
addr_h<39:4>	I/O	B_21164.SPI	VIOD_WC, VIOD_BC
addr_res_h<2:0>	O	O_21164.SPI	VOUT_WC, VOUT_BC
big_drv_en_h	I	I_21164.SPI	VIN_WC, VIN_BC
cack_h	I	I_21164.SPI	VIN_WC, VIN_BC
cfail_h	I	I_21164.SPI	VIN_WC, VIN_BC
clk_mode_h<2:0>	I	I_21164.SPI	VIN_WC, VIN_BC
cmd_h<3:0>	I/O	B_21164.SPI	VIOD_WC, VIOD_BC
cpu_clk_out_h	O	CO_21164.SPI	VCOUT_WC, VCOUT_BC
dack_h	I	I_21164.SPI	VIN_WC, VIN_BC
data_bus_req_h	I	I_21164.SPI	VIN_WC, VIN_BC
data_check_h<15:0>	I/O	B_21164.SPI	VIOD_WC, VIOD_BC
data_h<127:0>	I/O	B_21164.SPI	VIOD_WC, VIOD_BC
data_ram_oe_h	O	OL_21164.SPI	VOUTL_WC, VOUTL_BC
data_ram_we_h	O	OL_21164.SPI	VOUTL_WC, VOUTL_BC
dc_ok_h	I	I_21164.SPI	VIN_WC, VIN_BC
fill_error_h	I	I_21164.SPI	VIN_WC, VIN_BC
fill_h	I	I_21164.SPI	VIN_WC, VIN_BC
fill_id_h	I	I_21164.SPI	VIN_WC, VIN_BC
fill_nocheck_h	I	I_21164.SPI	VIN_WC, VIN_BC
idle_bc_h	I	I_21164.SPI	VIN_WC, VIN_BC
index_h<25:4>	O	OL_21164.SPI	VOUTL_WC, VOUTL_BC
int4_valid_h<3:0>	O	O_21164.SPI	VOUT_WC, VOUT_BC
irq_h<3:0>	I	I_21164.SPI	VIN_WC, VIN_BC
mch_hlt_irq_h	I	I_21164.SPI	VIN_WC, VIN_BC
oe_we_active_low_h	I	I_21164.SPI	VIN_WC, VIN_BC
osc_clk_in_h	I	C_21164.SPI	VINC_WC, VINC_BC
osc_clk_in_l	I	C_21164.SPI	VINC_WC, VINC_BC

(continued on next page)

Table 1 (Cont.) 21164 Alpha Pins with Corresponding Level 28 Models

Pin Name	Pin Type	File Name of Model	Model Subcircuits
perf_mon_h	I	I_21164.SPI	VIN_WC, VIN_BC
port_mode_h<1:0>	I	I_21164.SPI	VIN_WC, VIN_BC
pwr_fail_irq_h	I	I_21164.SPI	VIN_WC, VIN_BC
ref_clk_in_h	I	I_21164.SPI	VIN_WC, VIN_BC
scache_set_h<1:0>	O	O_21164.SPI	VOUT_WC, VOUT_BC
shared_h	I	I_21164.SPI	VIN_WC, VIN_BC
srom_clk_h	O	O_21164.SPI	VOUT_WC, VOUT_BC
srom_data_h	I	I_21164.SPI	VIN_WC, VIN_BC
srom_oe_l	O	O_21164.SPI	VOUT_WC, VOUT_BC
srom_present_l	I/O	B_21164.SPI	VIOD_WC, VIOD_BC
st_clk1_h	O	OL_21164.SPI	VOUTL_WC, VOUTL_BC
st_clk2_h	O	OL_21164.SPI	VOUTL_WC, VOUTL_BC
system_lock_flag_h	I	I_21164.SPI	VIN_WC, VIN_BC
sys_clk_out1_h	O	O_21164.SPI	VOUT_WC, VOUT_BC
sys_clk_out1_l	O	O_21164.SPI	VOUT_WC, VOUT_BC
sys_clk_out2_h	O	O_21164.SPI	VOUT_WC, VOUT_BC
sys_clk_out2_l	O	O_21164.SPI	VOUT_WC, VOUT_BC
sys_mch_chk_irq_h	I	I_21164.SPI	VIN_WC, VIN_BC
sys_reset_l	I	I_21164.SPI	VIN_WC, VIN_BC
tag_ctl_par_h	I/O	B_21164.SPI	VIOD_WC, VIOD_BC
tag_data_h<38:20>	I/O	B_21164.SPI	VIOD_WC, VIOD_BC
tag_data_par_h	I/O	B_21164.SPI	VIOD_WC, VIOD_BC
tag_dirty_h	I/O	B_21164.SPI	VIOD_WC, VIOD_BC
tag_ram_oe_h	O	OL_21164.SPI	VOUTL_WC, VOUTL_BC
tag_ram_we_h	O	OL_21164.SPI	VOUTL_WC, VOUTL_BC
tag_shared_h	I/O	B_21164.SPI	VIOD_WC, VIOD_BC
tag_valid_h	I/O	B_21164.SPI	VIOD_WC, VIOD_BC
tck_h	I/O	B_21164.SPI	VIOD_WC, VIOD_BC
tdi_h	I	IU_21164.SPI	VINU_WC, VINU_BC
tdo_h	O	O_21164.SPI	VOUT_WC, VOUT_BC
temp_sense	I	Model not provided ¹	Subcircuit not provided
test_status_h<1:0>	O	O_21164.SPI	VOUT_WC, VOUT_BC
tms_h	I	IU_21164.SPI	VINU_WC, VINU_BC
trst_l	I/O	B_21164.SPI	VIOD_WC, VIOD_BC
victim_pending_h	O	O_21164.SPI	VOUT_WC, VOUT_BC

¹ **temp_sense** should be left floating and not connected to etch, a voltage, or **Vss**.

Support, Products, and Documentation

If you need technical support, a *Digital Semiconductor Product Catalog*, or help deciding which documentation best meets your needs, visit the Digital Semiconductor World Wide Web Internet site:

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Product	Order Number
21164 Alpha 300-MHz Microprocessor for Windows NT	21164-P4
21164 Alpha 366-MHz Microprocessor for Windows NT	21164-P5
21164 Alpha 333-MHz Microprocessor	21164-EB
21164 Alpha 400-MHz Microprocessor	21164-FB
21164 Alpha 433-MHz Microprocessor for Windows NT	21164-P6
21164 Alpha 433-MHz Microprocessor	21164-HB
21164 Alpha 466-MHz Microprocessor	21164-IB
21164 Alpha 500-MHz Microprocessor for Windows NT	21164-P7
21164 Alpha 500-MHz Microprocessor	21164-JB
21164 Alpha 533-MHz Microprocessor	21164-KB
21164 Alpha 533-MHz Microprocessor for Windows NT	21164-P8
21164 Alpha 566-MHz Microprocessor	21164-LB
21164 Alpha 600-MHz Microprocessor	21164-NB
21164 Alpha 633-MHz Microprocessor	21164-MB

Motherboard Kits

Motherboard kits include the motherboard and the motherboard user's manual.

Product	Order Number
AlphaPC 164 WinNT Motherboard	21A04-B0
AlphaPC 164 UNIX Motherboard	21A04-B2
AlphaPC 164LX WinNT Motherboard	21A04-C0

Design Kits

Design kits include full documentation and schematics. They do not include evaluation boards or related hardware.

Product	Order Number
AlphaPC 164 Motherboard Design Kit	21A04-12

Ordering Digital Semiconductor Documentation

The following table lists some of the available Digital Semiconductor documentation.

Title	Order Number
Alpha AXP Architecture Reference Manual ¹	EY-T132E-DP
Alpha AXP Architecture Handbook	EC-QD2KB-TE
Digital Semiconductor 21164 Alpha Microprocessor Data Sheet	EC-QP98B-TE
Digital Semiconductor 21164 Alpha Microprocessor Hardware Reference Manual	EC-QP99B-TE
Digital Semiconductor 21164 Alpha Microprocessor Product Brief	EC-QP97C-TE
Alpha 21164 Evaluation Board Read Me First	EC-QD2VB-TE
Alpha 21164 Evaluation Board Product Brief	EC-QCZZD-TE
Alpha 21164 Evaluation Board User's Guide	EC-QD2UC-TE
Alpha 21164 Microprocessor Motherboard Product Brief	EC-QSAGA-TE
Alpha 21164 Microprocessor Motherboard User's Manual	EC-QLJLB-TE
AlphaPC 164 Motherboard User's Manual	EC-QPG0B-TE
AlphaPC 164 Motherboard Design Kit Read Me First	EC-QPFZA-TE
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Alpha Microprocessors Evaluation Board Software Design Tools User's Guide	EC-QHUVB-TE
Alpha Microprocessors Evaluation Board Windows NT 3.51 and 4.0 Installation Guide	EC-QLUAF-TE

¹To purchase the *Alpha AXP Architecture Reference Manual*, call **1-800-DIGITAL** from the U.S. or Canada, contact your local Digital office, or call Butterworth-Heinemann (Digital Press) at 1-800-366-2665.

Title	Order Number
Alpha Microprocessors SROM Mini-Debugger User's Guide	EC-QHUXB-TE
Alpha SRM Console for Alpha Microprocessor Evaluation Boards User's Guide	EC-QK8DE-TE
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